

Application No. 10/561,342
Amendment dated August 3, 2010
Reply to Office Action of May 19, 2010

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Docket No.: 69495(301067)

Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) A complex membrane for an electrochemical device, comprising:

~~a micro-porous polyolefin membrane~~ a strength support layer; and

a web-phase ~~porous~~ electrospinning membrane united to at least one side of the ~~micro-porous polyolefin membrane~~ strength support layer and ~~composed of nano-fibers made of polymer~~,

wherein the strength support layer is a micro-porous polyolefin membrane having a mean flow pore size of 0.005 to 3 μm and a porosity of 30 to 80%, and

wherein the electrospinning membrane is a web-phase porous membrane in which nano-fibers are accumulated by electrospinning to have a mean flow pore size of 0.01 to 3 μm and a porosity of 60 to 95%.

whereby the complex membrane is a multi-layer complex membrane having a mean flow pore size of 0.01 to 1.5 μm , a porosity of 40% or above and a thickness of 5 to 70 μm .

2. (Currently amended) The complex membrane according to claim 1,

wherein the micro-porous polyolefin membrane is a membrane having at least one layer composed of polyethylene polymer and/or ~~polyethylene~~ polypropylene polymer.

3. (Currently Amended) The complex membrane according to ~~claim 1~~ claim 2,

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wherein ~~the micro-porous polyolefin membrane~~ the strength support layer has a thickness of 5 to 50 μm and ~~a porosity of 30 to 80%.~~

4. (Cancelled)

5. (Currently Amended) The complex membrane according to ~~any of claims 1 to 4~~ claim 3,

wherein the nano-fiber is made of polymer selected from the group consisting of poly(vinylidene fluoride) (PVDF), poly(vinylidene)-co-(hexafluoropropylene) [P(VDF-HFP)], poly(acrylonitrile) (PAN), poly(vinylidene)-co-(acrylonitrile) [P(VDF-AN)] copolymer, poly(ethylene oxide) (PEO), poly(urethane) (PU), [P(VDF-AN)] copolymer, ~~poly(ethylene oxide) (PEO), poly(urethane) (PU),~~ poly(methylacrylate), poly(methyl methacrylate) (PMMA), poly(acrylamide) (PAA), poly(vinyl chloride) (PVC), poly(vinylacetate) (PVAc), poly(vinylpyrrolidone), polytetraethylene glycol diacrylate, poly(ethylene glycol dimethacrylate) (PEGDMA), cellulose, cellulose acetate, and ~~their mixtures~~ thereof.

6. (Cancelled)

7. (Currently Amended) The complex membrane according to ~~any of claims 1 to 6~~ claim 5,

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wherein the ~~web-phase porous membrane~~ polymer of the nano-fiber further contains a filler selected from the group consisting of SiO_2 , TiO_2 , Al_2O_3 , BaTiO_3 , LiO_2 , LiF , LiOH , LiN , BaO , Na_2O , MgO , Li_2CO_3 , LiAlO_3 , PTFE, and their mixtures thereof.

8. (Withdrawn) A method for manufacturing the complex membrane for an electrochemical device, defined in the claim 1, comprising:

- (a) preparing a micro-porous polyolefin membrane;
- (b) laminating a web-phase porous membrane made of nano-fibers on at least one side of the micro-porous polyolefin membrane; and
- (c) uniting the micro-porous polyolefin membrane with the web-phase porous membrane by applying predetermined pressure and temperature to the result of the step (b).

9. (Withdrawn) The method for manufacturing the complex membrane according to claim 8,

wherein, in the step (b), the web-phase porous membrane made of nano-fibers is laminated on one surface of the micro-porous membrane by directly spinning a polymer solution by means of electrospinning.

10. (Currently Amended) An electrochemical device, comprising:

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~~an electrode structure for an electrochemical device composed of anode, cathode and the complex membrane, defined in the claim 1, interposed between the anode and the cathode; and~~

~~an organic electrolyte moistened in the electrode structure.~~

an anode;

a cathode; and

a separator and an organic electrolyte interposed between the anode and the cathode,

wherein the separator is the complex membrane defined in the claim 1.

11. (New) The complex membrane according to claim 7,

wherein the electrospinning membrane has a thickness of 50 μm or below

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